

Colorado Geothermal Working Group

Meeting Agenda

April 8, 2008

LOCATION: Colorado School of Mines, Room 201, General Research Laboratory

TIME: 8:15am – 4:15pm

GeoPowering the West is a program that seeks to address barriers to geothermal utilization and identify opportunities for project development. The Colorado Geothermal Working Group maintains a focus on all categories of geothermal energy: electricity production; direct use and district heating; and geothermal heat pumps (geoexchange).

The intent of our meeting on April 8 is to review actions underway, address barriers, and identify opportunities for project development. Following presentations, we'll split into two groups for action planning and report back to the larger group.

Agenda

8:15 – 8:45am	Welcome and Introductions with Joanie Matranga, Governor's Energy Office (GEO) and Dag Nummedal, Colorado Energy Research Institute, Colorado School of Mines
8:45 – 9:15am	<i>Geological Resource Mapping Status</i> (NOTES PAGE 2) Matt Sares, Colorado Geological Service
9:15 - 9:45am	<i>Market Update for Colorado Geothermal Electricity</i> (NOTES PAGE 3) Daniel Fleischmann, Ormat Technologies Inc.
9:45 – 10:15am	<i>Update on BLM's Geothermal Program – Leasing/Development</i> (NOTES PAGE 4) Kermit Witherbee, Bureau of Land Management
10:15am – 10:30am	Short Break
10:30-11:00am	<i>Geothermal Regulations in Colorado</i> (NOTES PAGE 5) Kevin Rein, CO Dept of Water Resources David Dillion- Colorado Oil and Gas Commission
11:00 – 11:30	<i>Brainstorm Session: Geothermal and GSHP Financing /Legislation</i> (NOTES PAGES 6-8) Craig Cox, Interwest Energy Alliance & Joani Matranga, GEO
11:30 – 12:30pm	Lunch (provided)
12:30 – 1pm	Ground Source Heat Pump, Carbon Emissions Research Plan (NOTES PAGE 9) Michael Brandemuehl, University of Colorado, Boulder
1 – 1:30pm	GSHP Consumer/Utility Market Review (NOTES PAGE 10) Paul Bony, Delta Montrose Electric Utility
1:30 -2pm	GSHP Benefits /Issues White Paper (NOTES PAGE 11) Rich Mignogna, Colorado Public Utilities Commission
2-3:30 pm	Break Into Groups Ground Source Heat Pumps – Next Steps, moderator: Jeff Lyng (NOTES PAGES 12,13) Geothermal Electric – Next Steps, Trade Mission, moderator: Joani Matranga (NOTES PAGES 14,15,16)
3:30pm – 4:15pm	Group Reports – Next Steps

To reference these presentations, please visit

http://www.colorado.gov/energy/renewables/geothermal_workinggroup.asp

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Presenter / Organization :

Matt Sares, Colorado Geological Service

Bio : Matt Sares is Deputy Director of the Colorado Geological Survey (CGS). He has 26 years of geological experience, the last 17 years at the Colorado Geological Survey. At CGS he has been involved in compiling statewide information on Colorado's geothermal energy, groundwater geology, aquifer recharge, abandoned mines, and natural acid rock drainage. Mr. Sares holds a B.S., Geology, University of Toledo, and Professional Degree, Hydrogeology, Colorado School of Mines.

Presentation Title:

Geological Resource Mapping Status

Key Points / Take Aways:

- Potential for geothermal energy uses in Colorado include:
 - Geoexchange / Ground Source Heat Pumps (takes advantage of constant earth temperatures of ~55 degrees F)
 - Direct Use (>100 degrees F)
 - Electrical Generation (>200 degrees F)
- Current geothermal applications at hot / warm springs and wells across the state include:

Pools and Spas	18 sites
Space Heating	15 sites
Greenhouses	4 sites
Aquaculture	1 sites
District Heating	1 sites
Electricity Generation	0 sites
- Indicators of geothermal power potential including high heat flow, with geologically recent volcanism and faulting are evident in Colorado.
- Mapped the relationships of hot springs/wells with faults and volcanic deposits:
 - 67% of hot springs/wells are within 30 miles of Quaternary faults (< 2 million years old).
 - 75% of hot springs/wells are within 20 miles of Neogene volcanic deposits (<23 million years old)
 - Almost all hot springs/wells with temperature greater than 50°C are located within 25 miles of Neogene volcanic deposits.
- Areas of known high heat flow:
 - 1) Mt. Princeton-Buena Vista area (300-400 mW/m²),
 - 2) Rico-Ouray trend (200-300 mW/m²),
 - 3) Trinidad and eastern San Luis Basin area (up to ~200 mW/m²),
 - 4) Leadville-Georgetown area (up to 200 mW/m²)
- Oil and gas fields in sedimentary basins with relatively high geothermal gradient include the Wattenberg Field in the Denver Basin and much of the San Juan Basin near Durango.
- A Massachusetts Institute of Technology study of deep geothermal resources indicates that Colorado is 5th among the continental US states in the deeper (>10,000 ft) geothermal resource base accessible via Enhanced Geothermal Systems. In the 10,000-13,000 foot depth range, Colorado has the best geothermal resource in the US.

To reference this presentation, please visit
http://www.colorado.gov/energy/renewables/geothermal_workinggroup.asp

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Presenter / Organization :

Dan Fleischman, Ormat Technologies, Inc.

Bio : Daniel Fleischmann is the Project Initiation Manager of Ormat Nevada, Inc. He was previously the Research Coordinator of the Geothermal Energy Association, where he released nine publications. These include reports on geothermal policy, development, and resources for five individual states: Arizona, Idaho, Nevada, New Mexico, and Utah as well as a final report released in January of 2007 covering fourteen states, including Colorado, entitled "An Assessment of Geothermal Resource Development Needs in the Western United States". He has presented his research findings at conferences throughout the U.S.

Daniel has a Masters Degree in Public Policy from George Washington University, where he graduated Pi Alpha Alpha in May of 2005. He has previously performed research on transmission issues and environmental mitigation for the wind industry, and released an independent article, published in the February 2006 issue of North American Wind Power, entitled "Global Warming And The Role Of Wind Energy".

Presentation Title:

Developing Geothermal Resources in Colorado and the Western Markets

Key Points / Take Aways:

-The State of Colorado should actively strategize on how to work with the Forest Service to enable exploration for geothermal in areas that may include Forest Service lands. Most of the geothermal prospects in Colorado with potential for electrical generation are on or on the boundary of Forest Service lands.

-Resource characterization in Colorado would benefit from a slim hole or deep well test at one of the primary target areas currently being studied by the Colorado Geological Survey.

-Population growth, rising power prices, pollution and emissions of greenhouse gases, and reliance on energy imports are market forces that are affecting power markets significantly throughout the Western U.S., including Colorado. These market forces will continue to drive the demand for renewable energy (including geothermal power, direct use, and heat pumps).

To reference this presentation, please visit
[http://www.colorado.gov/energy/renewables/
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Presenter / Organization :

Kermit Witherbee, Bureau of Land Management

Bio : Kermit Witherbee currently serves as the Bureau of Land Management's National Geothermal Program Manager. Previous BLM assignments have included Deputy Division Chief, Fluid Minerals Division and division Manager, Fluid Minerals at the Bureau of Land Management (BLM), Headquarters, Washington, DC; Fluid Minerals Group Manager and Reservoir Management Branch Chief, Colorado State Office; and District Petroleum Geologist, Craig District, Craig, Colorado. Prior to joining BLM, he held positions as Exploration Geologist and Exploration Project Manager in private industry. His career with BLM has included staff and supervisory responsibilities in the oil and gas leasing and management, reservoir management, evaluations, as well as national level policy development, strategic planning, and budget. He worked for the House of Representatives Resources Committee as a Congressional Fellow during the 107th Congress. He has both a Bachelor's and Master's degrees in Geology from the State University of New York at Oneonta.

Presentation Title:

Update on BLM's Geothermal Program—Leasing / Development

Key Points / Take Aways:

The Bureau of Land Management (BLM) is continuing to implement the geothermal provisions of the Energy Policy Act of 2005 that significantly revised the Geothermal Steam Act of 1970, from essentially noncompetitive leasing to an all-competitive leasing system. Revised final Geothermal Regulations were published on May 2, 2007 and first lease sales held during June and August of 2007.

BLM and the U.S Forest Service are jointly preparing a Programmatic Environmental Impact Statement (PEIS) to analyze and expedite the leasing of BLM- and Forest Service-administrated lands with high potential for geothermal resources in 11 western states and Alaska, including Colorado. The draft PEIS is scheduled for release during May 2008 and the Final in late December 2008.

Once the PEIS is completed BLM will be accepting nominations for leasing geothermal resources in Colorado for both electrical generation and direct use applications. Lands that are available for leasing will be offered for competitive leasing. Those lease parcels not receiving bids will then be available for noncompetitive leasing for a period of two years following the sale. Applications for noncompetitive direct use leasing will be posted for a period of 90 days to determine whether or not there is competitive interest. If there is competitive interest, the lands requested will be offered in a competitive lease sale. If no competitive interest is expressed, the lease may be issued to the applicant.

To reference this presentation, please visit
[http://www.colorado.gov/energy/renewables/
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Presenter / Organization :

Kevin Rein, CO Department of Water Resources

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Bio : Kevin Rein is Chief of Water Supply in the Denver office of the Division of Water Resources; also known as the State Engineer's Office. He manages, and is directly involved with the teams that perform well permitting, subdivision water supply review, substitute water supply plan review, water court activity review, and numerous other items associated with the administration of surface and ground water in the state.

Presentation Title:

Geothermal Regulations in Colorado

Key Points / Take Aways:

For the purposes of drilling a well to access geothermal resources and divert ground water, the regulations in Colorado derive from statute [Section 37-90.5-101 – 108, C.R.S.] and the Geothermal Rules [2 CCR 402-10].

If geothermal fluid is tributary ground water, it is a public resource. There is no correlative right associated with land ownership.

If an effort to recover a geothermal resource involves a well, the operator must obtain a drilling permit from the State Engineer. The permitting process must consider injury to the geothermal resource and water rights.

Therefore, for an operation that diverts tributary ground water, article 37-90, (Ground Water Management Act) articles 37-92 (Water Right Determination and Administration Act) apply. This means that the operator may need to take action to augment depletions to the system and will be accountable for 'impacts' to the system.

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Craig Cox, Interwest Energy Alliance

Bio : Craig Cox is executive director of the Interwest Energy Alliance, a non-profit trade association that represents the nation's leading wind and utility-scale solar energy companies, bringing them together with regional non-governmental organizations. Working in Arizona, Colorado, Nevada, New Mexico, Utah and Wyoming, Interwest performs outreach and representational activities and seeks to build collaborative, consensus-based approaches to state policies that lead to new renewable project and transmission development throughout the West.

Presentation Title:

Brainstorm Session: Geothermal and GSHP Financing / Legislation

Key Points / Take Aways:

Craig Cox suggests a reiteration of the top 4 bullets from last year's legislative subgroup will be helpful as background on this ongoing discussion:

Key Policy Group Recommendations

Here are the top four policy recommendations from the Geothermal Working Group Policy Subgroup (2007), as determined by responses to our policy survey. Background information, gathered from various sources, is included strictly as a "starting point" for further research should interest in these particular policy options warrant.

Grants and loans

In a 2004 paper entitled "Geothermal Policy Options for States," the National Geothermal Collaborative (www.geocollaborative.org) wrote:

"Twenty states have grant programs to support renewable energy in the commercial, industrial and government sectors and for schools and utilities. Some programs focus on research and development, but most aim to encourage the purchase and installation of renewable energy equipment. Programs vary in the amount offered—from a few hundred dollars up to \$1 million— and some states set no limit.

States also offer low- or no-interest loans to help citizens buy renewable energy equipment. These loans are available to various sectors, including residential customers and large businesses. Twenty-five states have some sort of loan program that is administered either through the state or a utility. It also is possible for states to provide a loan guarantee on financing for renewable energy projects. Banks and lending institutions that have no experience financing such

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CRAIG COX, CONTINUED:

projects may be hesitant to do so. However, if a state were to guarantee a loan, it could facilitate renewable energy development by decreasing the risk for the lender and helping projects gain easier access to capital.

The California Energy Commission's Geothermal Program promotes geothermal energy in the state by extending financial and technical assistance to public entities for planning, project impact mitigation, and direct use projects. It also provides financial assistance to private entities for research, development, mitigation and commercialization projects. The funding comes from royalties that developers pay the federal government tied to geothermal energy production on federal leases in California. Typically, this program provides grants and loans each fiscal year."

Resource Assessments

On 6 April 2006, Roy Mink, DOE Program Manager of Geothermal Technologies, testified before the U.S. House Committee on Resources, Subcommittee on Energy and Mineral Resources:

"Resource assessment is an important activity, as the current success rate for discovering new geothermal (hydrothermal) fields is about 20 percent. Most new fields are "blind" in that there are no surface manifestations of the existence of hot water at depth. Much of the risk is up front, requiring investment in exploration, exploratory drilling, and resource assessment."

From "An Assessment of Geothermal Resource Development Needs in the Western United States," a January 2007 report by Daniel J. Fleischmann of the Geothermal Energy Association:

Resource assessments are one of the most critical needs for the geothermal industry, as outlined in existing reports on state development. Exploration technology is limited, and the cost of drilling new wells can be prohibitive. A challenge, according to land developers of residential or business geothermal direct use applications, is the lack of money available for drilling and exploring expressly for geothermal resources. According to these developers, finding geothermal water, even in areas where the resource is prevalent, is hit or miss. In the past, geothermal heating was usually developed only where availability was clearly demonstrated. Like with geothermal power projects, this availability was often based on existing hot springs or serendipitous discoveries, rather than substantive exploration and planning.

[...]

Overall, there is a pervasive concern that the academic and business communities have not been adequately linked, leaving geological studies to generally not

CRAIG COX, CONTINUED..

consider business opportunities and economic development as key components of their research. In order to bring more projects into the mainstream, state and federal agencies have been reaching out to those who have successfully developed geothermal direct use projects -- including businesses, companies, consultants, and contractors -- and encouraging them to share their knowledge. Clean energy advocates say this effort should both continue and expand. Several interviews suggest that experienced entities could be encouraged to report on geothermal direct use projects in industry trade magazines, such as greenhouse and aquaculture industry publications that provide visibility about geothermal technology to a broader audience.

Drilling incentives

From presentation slides to Colorado Geothermal Working Group by Dan Phaure (policy subgroup member) of Dundee Securities, 31 January 2007:

"Existing Federal incentives (PTCs, accelerated depreciation and depletion allowances) are usually sufficient to spur development post-feasibility study but are of no help in the pre-feasibility study phase.

Drilling incentives would be instrumental in advancing geothermal activity and enhancing capital availability."

State renewable purchases

As contrasted from state Renewable Portfolio Standards, state renewable energy purchase requirements can differ greatly, but most states that have such requirements apply them to state-owned facilities. Several states with state renewable energy purchase requirements do not have RPS laws.

From the EPA's State and Local Clean Energy Programs page at <http://www.epa.gov/cleanenergy/stateandlocal/activities.htm>,

Clean Energy Goals for Public Facilities

State lead by example measures include establishing clean and/or renewable energy purchasing or generation goals for their own facilities. These goals may take the form of requirements to obtain a certain percentage of electricity usage from clean renewable generation sources, or a minimum clean energy purchase volume (in megawatt-hours) by a given date. They may also take the form of goals for self-generation of clean or efficient energy, such as clean distributed generation or combined heat and power. These goals can be met through a variety of methods including onsite generation, purchasing clean renewable energy power products, or by purchasing renewable energy certificates. States that have requirements to implementing specific renewable energy measures without an aggregate goal are differentiated on the map.

Presenter / Organization :

Jeff Lyng (for Michael Brandemuehl, CU Boulder)

Bio : Jeff Lyng is the Commercial Buildings and Solar Program Manager at the Colorado Governor's Energy Office (GEO). At the GEO he is responsible for overseeing commercial building energy efficiency and renewable energy in state, local government and K-12 infrastructure. He also manages the state's Residential Solar Program.

Prior to joining the Governor's Energy Office, Jeff worked as a Technical Consultant at Xcel Energy on the company's demand side management and renewable energy programs. Jeff's undergraduate training is in Ecology from SUNY-ESF and he earned a Masters of Engineering degree in energy from the University of Colorado at Boulder Building Systems Program. Jeff's thesis work focused on implementing solar energy in the Colorado production home market.

While at CU, Jeff served as the project manager for the 1st Place 2005 Solar Decathlon Team. Following the Solar Decathlon, he had the opportunity to testify before the U.S. House of Representatives Subcommittee on Energy and was a guest of First Lady Laura Bush at the 2006 State of the Union Address.

Presentation Title:

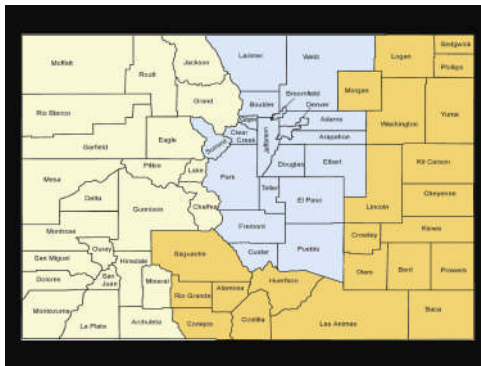
Colorado's New Energy Economy Policy

Key Points / Take Aways:

The Governor and the Legislature partnered to pass 20 energy efficiency and renewable energy bills. Implementation is underway at the state's electric and gas utilities, at the Colorado Public Utilities Commission, and at the Governor's Energy Office (GEO).

The Colorado Climate Action Plan aims to reduce Greenhouse gas emissions by 20% from 2005 baseline by 2020. 20% reduction in CO2 emissions from the utility sector will be through energy efficiency initiatives (50%), Renewables (33%), and Clean Coal (17%).

Initiatives underway at GEO include energy and water saving projects in state buildings (currently 5,600 buildings, 63M SF) through performance contracting, and a focus on energy efficient schools. There are 3 regional representatives within the GEO:



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Central Regional Representative: Mona Newton,
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Eastern Regional Representative: Bob Mailander,
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To reference this presentation, please visit
[http://www.colorado.gov/energy/renewables/
geothermal_workinggroup.asp](http://www.colorado.gov/energy/renewables/geothermal_workinggroup.asp)

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Presenter / Organization :

Paul Bony, Delta Montrose Electric Utility

Bio : Paul Bony has over 20 years of utility experience, including energy conservation, demand-side management and customer service. Under his leadership during the past 10 years, more than 600 GeoExchange systems have been installed in over 20 towns in Southwest Colorado, through Intermountain Energy, a subsidiary of Delta-Montrose Electric Association.

DMEA's innovative Co-Z Energy Plan helps customers afford geothermal heat pump systems that provide long-term comfort and savings. The Association of Energy Services Professionals International presented DMEA with its 2003 "Achievement in Energy Services" Award for the "Co-Z Energy Plan." Paul earned his M.B.A. from the University of Nevada and a B.S. from Kansas State University's College of Agriculture.

Presentation Title:

Ground Source Heat Pumps Consumer / Utility Market Review

Key Points / Take Aways:

Propane (and soon natural gas) space heating is more expensive than heating with electric resistance heat and customers are responding by switching to electric resistance heat through central electric furnaces and "plug-in" heaters.

Ground source heat pumps provide the only affordable alternative to both utilities (who are short of generation capacity) and consumers.

In addition, GSHPs offer utilities an excellent opportunity to improve their load factor while reducing the total carbon footprint of space conditioning.

For GSHPs to become mainstream, the technology needs to be declared a renewable energy source by State and national government and it needs to be given the same market incentives other renewable energy technologies receive.

In addition, a robust loop implementation infrastructure needs to be developed, especially for vertical (drilled) loops in high density urban areas.

To reference this presentation, please visit
[http://www.colorado.gov/energy/renewables/
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Presenter / Organization :

Rich Mignogna, Colorado Public Utilities Commission

Bio : Dr. Richard Mignogna is a Professional Engineer with the Colorado Public Utilities Commission where his principal responsibilities have centered on the implementation of Colorado's renewable energy mandate, more commonly known as Amendment 37 (A37). In this capacity, he has had primary responsibility for assisting the state's regulated and nonregulated utilities in complying with the requirements of A37 and for evaluating regulatory filings in all areas of renewable energy. He has also worked closely with the state's regulated utilities and stakeholder groups on the implementation of the solar incentive programs mandated by A37. In September 2007 he became the first PUC Staff member assigned to the newly formed *Research & Emerging Issues Section* at the PUC, a group reporting directly to the Commissioners and tasked with broad responsibilities for developing and analyzing policy initiatives to foster the development of clean energy technologies. Responsibilities in this position involve industry and technology analysis to stay abreast of market and technological developments impacting renewable and clean energy policy initiatives. Dr. Mignogna formerly held positions as Director of Technology Commercialization at the National Center for Atmospheric Research and was the founding director of the Management of Technology master's program at the University of Denver. He holds B.Sc. and M.S. engineering degrees from the Colorado School of Mines, an MBA from the University of Denver, and a Ph.D. from the University of Colorado.

Presentation Title:

A Discussion of Ground Source (Geothermal) heat Pumps and Their Role in Renewable Energy and Energy Efficiency Policy

Key Points / Take Aways:

Ground source (aka Geothermal) heat pumps (GSHP) are energy efficiency devices that provide economic and environmental benefits over conventional, fossil fuel driven space heating and cooling systems. The magnitude of these benefits is largely a function of the cost and carbon intensity of the specific fuel being displaced.

An incentive program to help overcome the higher first cost of GSHP systems appears warranted. However, GSHP should not be listed as an eligible renewable technology under Colorado's Renewable Energy Standard because the systems do not produce electricity and do not replace grid electricity in Colorado to any significant extent. Rather, it would be more appropriate to include GSHP as an energy efficiency technology suitable for incentives under a Demand Side Management program.

The Geothermal Heat Suppliers Act (§40-40-101 *et. seq.*, C.R.S.) provides a potential mechanism under which third-party developers could own and operate GSHP systems for consumers who would pay a thermal energy charge in lieu of ownership costs.

To reference this presentation, please visit

http://www.dora.state.co.us/puc/presentations/WhitePapers/GSHP_PublicPolicy08Apr08MignognaWhitepaper.zip

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Work Session :

Ground Source Heat Pumps—Next Steps

Moderator: Jeff Lyng, Governor's Energy Office (GEO)

Recommendations on CU Boulder GSHP study:

Why not open this study up as a Collaboratory project with NREL involvement as well? Who is the NREL GSHP guru?

The group did not know. However, the contact at Oak Ridge N.L. is Patrick Hughes. Also, the study should involve the Institute for the Built Environment, CSU – Brian Dunbar.

Commissioning a Colorado-based study is a plus for political reasons -- CO legislature, CPUC and others give preference to Colorado specific data.

An objective approach is much stronger than an industry-lead analysis.

Recommendation that the study stay broad on the benefits – i.e. beyond GHG savings (including auxiliary energy uses such as domestic hot water, energy security, etc.)

A quantification of the non-energy benefits also needs to be done.

Little or no literature exists for CO specifically on geoexchange / GSHP.

Importance of emissions factors and baseline htg/cooling systems was stressed.

A study like this could be very useful to the industry in landing GSHP sales as it would seem to legitimize the technology and the industry having been done by a third party.

Complexity of the retrofit market will make modeling pre and post scenarios very difficult. How do we narrow down to the most common pre and post conditions? There are seemingly "limitless" variables. The challenge will be to bundle them.

Modeling of the retrofit market is important to "be ready" as the consumer price threshold is met due to rising NG and Propane costs.

Recommend following up the modeling with an assessment of the net savings potential in the retrofit market – what percentage of the Climate Action Plan can be achieved through GSHP retrofits?

Case Studies

The need for case studies is dire. Only a few exist in Colorado. Poudre School District (Zach Elementary, Fossil Ridge High School) are the most well known.

A shortcoming of most case studies is that they do not include empirical data collection post install, but need to in order to create greater consumer buy-in. The 'Millenium Building' was once touted as the most energy efficient building in Colorado. It has a GSHP and ought to be the subject of a case study to determine the systems performance – empirical data.

Mktg opportunity at the Governor's Residence

Chevron is installing a GSHP at the residence as part of the Capital Complex Performance Contract. The system is scheduled for completion in the fall (should check with Lance Shepherd on this). Highlighting the residence system would be ideal to launch a state-wide incentive program.

"Loop Tariff"

This is something that Paul Bony had mentioned that DMEA is doing. The discussion here was around whether or not schools represent an opportunity for a customized rate, similar to the idea of DMEA's Loop Tariff, particularly those employing GSHP technology.

Reasoning:

Schools with GSHP offer greater load factor to the utility than do conventional buildings. In addition, schools peak in demand in the wintertime and, during the summer, are largely unoccupied

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(Continued, GSHP breakout group)

by the time the utility peak period begins (early afternoon). Therefore, why are schools on the basic Secondary General (Xcel's SG) rate if they are using more energy during the periods at which the utilities margins are the greatest? Why are schools paying proportionately more than the average commercial user?

GSHP Committee

Sign up sheet of those who are interested in being on the GSHP steering committee was generated.

This committee has offered to peer review the CU study in addition to advising on a GEO GSHP program.

The group recommended that the GEO hire an intern to pull together the recommendations of the GSHP committee.

Miscellaneous

Canadian government offers free GSHP design software. I think they were referring to RETScreen (P.S. I have used RETScreen for solar projects and it is a very effective tool).

http://www.retscreen.net/ang/g_ground.php

This site has good information as well.

<http://oee.nrcan.gc.ca/publications/infosource/pub/home/heating-heat-pump/gsheatpumps.cfm>

Work Session :**Geothermal Electric—Next Steps-
Nevada Trade Mission**

Moderator: Joani Matranga, Governor's Energy Office (GEO)

Joani Matranga distributed the following list of topics for discussion and consideration in planning the June 2008 Nevada Trade Mission:

Purpose: Provide Colorado attendees with ample opportunities to learn about the many aspects of geothermal business development, and dialog with Nevada counterparts, in an informal and open environment.

Understanding the Geothermal Resource

Global geothermal zones (magmatic and extensional)

Uses of Geothermal:

Direct Use (production wells, heat exchangers, injection wells)

Ground Source Heat Pumps

Electric Generation Powerplants (Double Flash, Binary Power)

Exploration techniques – geophysical and remote sensing

Resource assessment technology, and utilization options

Surface and subsurface lithology and drilling objectives

Benefits (availability, small plant footprint, easy installation, low operating costs)

Nevada – Overview of Geothermal Industry

Geothermal Powerplants, locations, costs and schedules for 5, 10 and 20 MW projects

Incentives to geothermal development

Geothermal areas (public lands / tribal lands / private lands)

"Green Fields"

Renewable Portfolio Standard (RPS), and Nevada's response to RPS legislation

Federal Leasing

Projects with Native Americans / Tribal Renewable Energy

Legal, Regulatory: Permitting and Land Issues:

state and federal policy considerations

The Energy Policy Act of 2005, and Production Tax Credit

Water Law / geothermal law

BLM role in permitting renewable exploration and development (tribal lands)

Bureau of Indian Affairs (BIA) role in permitting renewable exploration and development

History, process, compliance with Nevada regulations

Site Visits and Tours:

Brady's Hot Spring Geothermal Power Plant (25 MW, binary and flash technology)

Con-Agra / Gilroy Geothermal onion dehydration plant

Drilling Site(s) at a production well

Steamboat Geothermal Area (South of Reno)

Credible developer with a proven track record

Site control and rights to use the geothermal resources

Typical plant-related costs per kilowatt installed

Overcoming typical project hurdles

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(Nevada Trade Mission Topics, Continued)

Business Development and Public / Private Relations

Churchhill County and geothermal developers at Brady Hot Springs (case study to include planning and land use, incentives, mutual benefits)
 Project development considerations
 Federal Funding
 Private Sector Funding
 Requirements for acquisition of financing:
 Proven resources and bankable report
 Credit-worthy power purchaser
 Power Purchase Agreements (PPA)

Resources Overview:

DOE GeoPowering the West (GPW) – goals, benefits, methodology, emerging tech.
 Geothermal Resources Council (GRC)
 Geothermal Education Office
 Geothermal Energy Association
 International Geothermal Association
 National Laboratories (NREL)

The group discussed adding the following topics to the Trade Mission:

Additional Site Visits:

District heating system – residential
 Casino application
 Great Basin Center for Geothermal Energy, University of Nevada
 Ormat Geothermal Complex – injection wells.

Applications:

Dennis Trexler (sp?) – district heating (direct use) operated by Nevada Geothermal Utility (ref: Dan Fleischman)

Legal / Ownership / Property Rights:

Issue of Injury and management to reduce:
 Groundwater modeling as method to identify extent of potential injury

Project Management / Critical Path:

Have a description of the total geothermal resource available in CO – ask what our path should be to develop.
 Discuss the model for NV success – what were the steps taken?
 What are the roadblocks to be aware of, and can they be avoided?

Technical Topics:

Exploration technology and reservoir characterization -
 Geothermax(sp?) – provides evaluation of the resource for financing study
 Comparison of CO2 emissions between geothermal vs coal power electric

Community Considerations:

What is it like for the community to have a geothermal plant development in the area? What are the community benefits realized from a standard power plant development?

Economic Considerations:

For investment potential, what is the relative cost of energy for the region? (Use 300 MW installed capacity of geothermal as a standard size power plant)

Transmission path - another key factor in evaluating economics of power plants

Land process for federal, state and private use

Is there an existing formula for investment that takes into account all the key factors?

Environmental Impacts to Land:

What is the drilling impact, and other impacts in comparison to oil and gas exploration? (see video for time efficiency)

What is the overall sustainability of this resource?

What are the residual impacts to a geothermal reservoir, and how is this determined?

Who should participate? (30 people total)

State senators and representatives, community leaders, county commissioners, technical experts, Ute Mountain Utes (?), environmental advocate groups (Sierra Club, Wilderness Workshop)

Tentative Schedule: 2.5 days total – add a day for geoscientists?

Day 1 - pm networking reception

Day 2 – am presentations, tour of Brady and Conagra, dinner (policy, topic of “injury”, and permitting process)

Day 3 – am presentations, tour of Steamboat